

Specification No.: \*\* 2003-011

Revision No.: 00

## APS SPECIFICATION SUBMISSION & REVISION FORM

DESCRIPTION: Statement of Work for PSS Generation 3

### SPECIFICATIONS REQUEST

#### SPECIFICATIONS PREPARED BY:

Roy Emerson  6/30/03  
Signature Date

#### REVIEW OF SPECIFICATIONS BY REQUESTING DIVISION (e.g. group leader, machine manager):

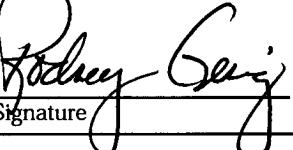
John Carwardine  6.30.03  
Signature Date

### SPECIFICATIONS ACCEPTANCE

#### GROUP LEADER:

John Carwardine  6.30.03  
Signature Date

#### DIVISION DIRECTOR:

Rod Gerig  6/30/03  
Signature Date

### CHANGES IN THIS REVISION:

New Document

All accompanying documents must contain the Specification and Revision numbers.

\*\* Call 2-5511 (ASD Division Office) for a Specification Number.

Completed Specifications and Submission Forms should be given to Kelly Jaje, Bldg. 401,  
Room C4253.

12/12/02

**Advanced Photon Source  
Argonne National Laboratory  
9700 South Cass Avenue  
Argonne, Illinois 60439**

**Document No. 4104-00003-00**

**Statement of Work  
for  
PSS Generation 3**

**Revision: 000**

**WBS No. X. 4.1.4**

Prepared by Roy Emerson  
Roy Emerson, Originator

Date 6/30/03

Approved by J. Carwardine  
John Carwardine, Group Leader

Date 6.30.03

Approved by Rodney Geig  
Rodney Geig, Division Director

Date 7/2/03

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## REVISION RECORD

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## 1. Purpose

Develop a new PSS interlock system to be used as the standard implementation for new beamline builds.

## 2. Scope of Work

### 2.1 In scope (current)

- 2.1.1 PSS requirements, description and configuration.
- 2.1.2 ICD for ACIS.
- 2.1.3 ICD for Front End and Beamline shutters.
- 2.1.4 ICD for FEEPS & BLEPS.
- 2.1.5 ICD for DIW.
- 2.1.6 ICD for HMI.
- 2.1.7 ICD for EPICS.
- 2.1.8 PSS electrical system design.
  - 2.1.8.1 Mezzanine including FERDP.
  - 2.1.8.2 Station
  - 2.1.8.3 Chain-A, Chain-B, and Chain-C systems.
  - 2.1.8.4 HMI system
  - 2.1.8.5 Provisions to allow future automated validations.
- 2.1.9 Test adapters to perform manual validations.

### 2.1 In scope (future)

- 2.1.1 Fully automated validations.
- 2.1.2 Retrofit Capabilities
 

Plan for graded implementation of Generation-3 capabilities at existing Generation-1 and Generation-2 beamlines.
- 2.1.3 New PSS Simulator.
- 2.1.4 Integrate FEEPS/BLEPS into HMI.

### 2.2 Out of scope

#### 2.2.1 Field devices

For field devices such as (door switches, speakers, etc, etc) – the devices approved for use in Generation-1 systems will apply.

#### 2.2.2 Pneumatic controls

The pneumatic controls for front-end shutters, beamline shutters and for station doors are the responsibility of another group.

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### 3. Applicable Documents

#### 3.1 Government Documents

The following documents of the exact issue shown form a part of this specification to the extent specified herein. In the event of conflict between the documents referenced herein and the contents of this specification, the contents of this specification shall be considered a superseding requirement.

DOE ORDER 420.2, 11-5-98

Accelerator Safety Implementation Guide for DOE O 420.2, Draft, May 1999

DOE ORDER 5480.25, 11-3-92

DOE GUIDANCE 5480.25, September 1, 1993

Copies of specifications, standards, drawings and publications required by suppliers in connection with specified procurement functions should be obtained from the contracting agency or as directed by the contracting office.

#### 3.2 Non-Government Documents

The following documents of the exact issue shown form a part of this specification to the extent specified herein. In the event of conflict between the documents referenced herein and the contents of this specification, the contents of this specification shall be considered a superseding requirement.

APS Safety Assessment Document(SAD), Rev 1, May 1999, Argonne National Laboratory, Argonne, IL.

Argonne National Laboratory Environment, Safety & Health Manual, May 27, 1999

Compliance with the following required by SAD

SLAC Report 327, April 1988, Stanford Linear Accelerator Center, Menlo Park, CA.

NCRP Report No. 88, Issued 30 December 1986, National Council on Radiation Protection.

Technical society and technical association specifications and standards are generally available for reference from libraries. They are also distributed among technical groups and using Federal Agencies.

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## 4. Goals and Objectives

### 4.1 Operational and Safety Considerations

- Meet the safety and operational needs of the APS beamlines in a cost-effective manner
- Meet the operational and reliability needs of APS machine and beamline operations

### 4.2 System Design Life

System should be designed with the intention of building this version for five years and supporting it for ten years.

### 4.3 System Capabilities

#### 4.3.1 Flexible

The system shall be sufficiently flexible to accommodate all known and anticipated beamline configurations.

#### 4.3.2 Expandable

The system shall be sufficiently expandable to accommodate all known and anticipated beamline configurations.

#### 4.3.3 Reliability

The system shall be reliable to support the reliability goals of the accelerator and beamlines.

#### 4.3.4 Availability

The system shall be easily serviceable to support the availability goals of the accelerator and beamlines.

### 4.4 System Complexity

System should not be unnecessarily complicated to operate or support, so as to minimize the possibility of human error during operation, validations, and servicing.

### 4.5 Standardization

As much as practical, the system should use standardized hardware and software configurations to simplify support and maintenance.

### 4.6 Self Diagnostics

As much as reasonable, system should provide self-diagnostics for troubleshooting and fault information.

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## **Goals and Objectives - Continued**

### **4.7 Validation Improvement**

#### **4.7.1 Non-Invasive Validations**

Support will be provided for non-invasive PSS validations, including the following:

- Removal and re-connection of existing field wiring should be minimized when performing PSS validations. Connection of additional devices (eg to dedicated connectors) is acceptable. Removal of field wiring to make such connections (eg as done now for front-end simulator) is not acceptable.
- Monitoring of plc status required for PSS validations should not require direct access to the plc code, as is done now. Hookup of a separate computer is acceptable provided it does not make or facilitate changes in plc code or checksums.
- Downloading of PSS code should be streamlined to minimize the possibility of errors.

#### **4.7.2 Time Reduction**

System design should facilitate reducing PSS validation times.

#### **4.7.3 Validation Quality**

There must be no compromise in the system coverage of the validation.

#### **4.7.4 Self Test Capability**

As much as reasonable, system should provide self-test capabilities, eg to perform a partial PSS validation with a button push.

### **4.8 EPICS Support**

All information that could be valuable for operations support shall be provided to EPICS. This included event capture, trending, and problem diagnosis.

### **4.9 Backward Compatibility**

It should be possible to retrofit key benefits of Generation-3 to existing Generation-1 and Generation-2 systems. At a minimum, it should be possible to eliminate needs to remove field wiring when hooking up validation equipment. It is also desirable to provide support for self-test and automated PSS validations, and for other benefits as appropriate

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## 5. Project Deliverables

### 5.1 Baseline Documents

- 5.1.1 PSS Statement of Work
- 5.1.2 PSS Project Schedule
- 5.1.3 PSS System Requirements
- 5.1.4 PSS Functional Description
- 5.1.5 PSS Beamline Configuration Specification

### 5.2 Interface Control Documents (ICD)

- 5.2.1 Access Control Interlock System (ACIS) interface with PSS
- 5.2.2 Front End and Beamline shutters
- 5.2.3 Front End Equipment Protection System (FE-EPS) interface with PSS
- 5.2.4 Beamline Equipment Protection System (BL-EPS) interface with PSS
- 5.2.5 De-Ionized water (DIW) interface with PSS
- 5.2.6 HMI interface with PSS
- 5.2.7 EPICS interface with PSS

### 5.3 PSS Mezzanine Controls

- 5.3.1 Electrical design and layout

### 5.4 PSS Station Controls

- 5.4.1 Electrical design and layout

### 5.5 Manual Validation Test Adapters

- 5.5.1 Front-End Simulator
- 5.5.2 Manual test boxes

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## Project Deliverables Continued

### **5.6 Lab Prototype system**

- 5.6.1 Software design specifications
- 5.6.2 Hardware design specifications
- 5.6.3 Validation Procedures
- 5.6.4 Fabrication and Test

### **5.7 Beamline System (30ID)**

- 5.7.1 Software design specification
- 5.7.2 Hardware design specifications
- 5.7.3 Validation Procedures
- 5.7.4 Fabricate a fully functional 30-ID system

### **5.8 Operational Prototype Evaluation (30-ID)**

- 5.8.1 Evaluation Criteria  
Evaluate the fully functional 30-ID prototype system with 1700 hours of reliable beamline operation.
- 5.8.2 Acceptance Criteria  
Successful system operation for the 1700 hour run period.

### **5.9 Goal and Objective Compliance Matrix**

The compliance matrix (located in Appendix B) will be used to demonstrate how the goals and objectives have been met.

## **6. Schedule**

Refer to project schedule document number 4104-00000-00 for specific time lines and milestones.

## **7. Cost/Budget**

Authorized expenditure for materials and services is \$80,000. Approvals will follow normal ES Group routes

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## 8. List of Stakeholders

### 8.1 Collaborative Access Teams (CAT)s

Members of the CAT who are the beamline users.

For prototype implementation, this is specifically the IXS-CAT Director.

### 8.2 APS Management

ASD and AOD Division management provide oversight and funding.

### 8.3 ASD Electrical Systems Group

Personnel and management of the ASD Electrical Systems Group have the primary responsibility for all PSS systems.

## 9. Responsibility

### 9.1 Core project team members:

Roy Emerson (project engineer), John Servino, Steve Ross, Mike Fagan

### 9.2 Review Committee:

Mohan Ramanathan (chair), John Forrestal, Nick Friedman, Jon Hawkins, Marty Knott, Jonathan Lang, Josh Stein

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### 9.3 Project Responsibility Matrix

<b>Responsibility</b>	ASD Division Director (Rod Gerig) PSS Gen-3 Review Committee	ES Group Leader (John Carwardine) Project Engineer (Roy Emerson)	Steve Ross	John Servino	Mike Fagan	Tom Dawson	Anne Boron	Mariana Varotto	Van Nguyen	APS Radiation Safety Committee	IXS-CAT Director
<b>Base Line Documents</b>											
SOW	4	6	4,5	1	6	3,6	3,6				
Project Schedule	4	6	4,5	1	3,6	3,6	3,6				
Requirements Specification	4	6	4	5	6	3,6	1				
Functional Description	4		4	5		3,6	1				
Beamline Configuration Spec	4		4	5		1	3,6				
Goals Compliance Matrix			4	1							
<b>Interface Control Documents</b>											
ACIS interface to PSS		4	5			1					
Front End and Beamline shutters		4	5			1					
FE-EPS interface to PSS		4	5			1					
BL-EPS interface to PSS		4	5			1					
DIW interface to PSS		4	5			1					
EPICS interface to PSS		4	5			1					
HMI interface to PSS		4	5			1					
<b>Hardware Design</b>											
New FERDP Design		4	5,6	1		3					
PSS Mezzanine Design		4	5,6	1	3	3					
PSS Station Design		4	5,6	1	3	3					
Printed Circuit Boards		4	5,6	1							
Front-End Simulator		4	5,6	1							
Manual Test Box		4	5,6	1							

#### Legend

1 – Task designer -primary  
4 – Task approver

2 – Task supervisor  
5 – Supervisory oversight

3 – Task resource  
6 - Must be notified

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Project Responsibility Matrix - Continued

<b>Responsibility</b>	ASD Division Director (Rod Gerig)	PSS Gen-3 Review Committee	ES Group Leader (John Carwardine)	Project Engineer (Roy Emerson)	Steve Ross	John Servino	Mike Fagan	Tom Dawson	Anne Boron	Mariana Varotto	Van Nguyen	APS Radiation Safety Committee	IXS-CAT Director
<b>Software Design</b>													
Chain-A ESD Code			5		6	6		1					
Chain-B ESD Code			5		6	6			1				
Chain-C C&C Code			5		1	6		6	6				
HMI Interface			5		1	6		6	6				
EPICS Interface			1		6	6		6	6				
<b>LAB Prototype Beamline</b>													
User Requirements Specification	4	6		6	6		1		6				
Input / Output & Fault List		6		1	6		6	6	6				
HMI Specification		6	6	1	6								
EPICS Specification		1		6	6		6	6	6				
Validation Procedure		6						6	6	1			
PLC Programming Chain-A/B/C		6		1	6		1	1					
HMI Programming		6		1	6		6	6					
EPICS Programming		1						6	1,6				
Fabrication	4	6	1										

**Legend**

1 – Task designer -primary  
4 – Task approver

2 – Task supervisor  
5 – Supervisory oversight

3 – Task resource  
6 - Must be notified



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#### **9.4 Electrical Design/Drawings Responsibility Matrix**

## Legend

1 – Task designer -primary  
4 – Task approver

2 – Task supervisor  
5 – Supervisory oversight

3 – Task resource  
6 - Must be notified

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## 10. Assumptions and Agreements

### 10.1 Interim design review

Interim design review focusing on testing methodology and implementation must be approved prior to start of design.

### 10.2 PLC training and software licenses

ESD and C&C PLC training and software licenses ASAP. Purchase or borrow test equipment.

## 11. Communication Plan

### 11.1 Project engineer will provide the following

- An approved statement of work (this document). This will be issued as an ASD Specification, and will be reviewed/approved appropriately.
- List of major tasks and milestones.
- Project schedule, including resource requirements and dates for meeting major milestones.
- Schedule for providing project ‘deliverables.’
- Monthly progress reports.

## 12. Reviews and Approvals

### 12.1 Safety Approvals

- Safety approval from APS Radiation Safety Policy Committee.

### 12.2 Design Reviews

- Interim design review focusing on architecture options.
- Interim design review focusing on testing methodology and implementation.
- Pre-implementation design review (prior to implementation of prototype system).
- Final design review (following successful testing of prototype system).

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## Appendix A

### ACRONYMS

The following are some of the frequently appearing or unique acronyms used in this document. This list is provided as a quick reference for the reader's convenience.

ACIS	Access Control Interlock System
APS	Advanced Photon Source
ARR	Accelerator Readiness Review
ASD	Accelerator Systems Division
BL/EPS	Beamline Emergency Protection System
CAT	Collaborative Access Team
DIW	De-ionized Water
EPICS	Experimental Physics and Instrumentation Control System
EPS	Equipment Protection System
ES	Electrical Systems Group
FDR	Final Design Review
FE/EPS	Front End Emergency Protection System
FERDP	Front End Relay and Distribution Panel
FOE	First Optics Enclosure
HMI	Human Machine Interface
ICD	Interface Control Document
ISIG	Interlocks Systems and Instrumentation Group
OI	Operator Interface
PDR	Preliminary Design Review
PLC	Programmable Logic Controller
PSS	Personnel Safety Systems
SRI	Synchrotron Radiation Instrumentation
TBD	To Be Decided
XFD	Experimental Facilities Division

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## Appendix B

### Goal and Objective Compliance Matrix

ID	Goal or Objective	Measurement Method	Qualification Level	Status
<b>4.1</b>	<b>Operational and Safety Considerations</b>			
	Meet the safety and operational needs of the APS beamlines in a cost-effective manner	Functional Evaluation		
	Meet the operational and reliability needs of APS machine and beamline operations	Functional Evaluation		
<b>4.2</b>	<b>System Design Life</b>			
	System should be designed with the intention of building this version for five years and supporting it for ten years.	Design Review		
<b>4.3</b>	<b>System Capabilities</b>			
	The system shall be sufficiently flexible to accommodate all known and anticipated beamline configurations.	Design Review		
	The system shall be sufficiently expandable to accommodate all known and anticipated beamline configurations.	Design Review		
	The system shall be reliable to support the reliability goals of the accelerator and beamlines.	Fault Logging		
	The system shall be easily serviceable to support the availability goals of the accelerator and beamlines.	Technician Service Reports		
<b>4.4</b>	<b>System Complexity</b>			
	System should not be unnecessarily complicated to operate or support, so as to minimize the possibility of human error during operation, validations, and servicing.	Beamline User Opinion		

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## Goal and Objective Compliance Matrix - Continued

ID	Goal or Objective	Measurement Method	Qualification Level	Status
<b>4.5</b>	<b>Standardization</b>			
	As much as practical, the system should use standardized hardware and software configurations to simplify support and maintenance.	Design Review		
<b>4.6</b>	<b>Self Diagnostics</b>			
	As much as reasonable, system should provide self-diagnostics for troubleshooting and fault information.	Design Review		
<b>4.7</b>	<b>Validation Improvement</b>			
	<b>Non-Invasive Validations</b>			
	No Removal and re-connection of existing field	Design Review		
	PLC status monitoring during validation with separate non-programming computer.	Design Review		
	Code downloading method improved to eliminate errors.	Design Review		
	<b>Time Reduction</b>			
	System design should facilitate reducing PSS validation times.	Comparison to similar beamline		
	<b>Validation Quality</b>			
	There must be no compromise in the system coverage of the validation.	Design Review		
	<b>Self Test Capability</b>			
	As much as reasonable, system should provide self-test capabilities, eg to perform a partial PSS validation with a button push.	Design Review		

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### Goal and Objective Compliance Matrix - Continued

ID	Goal or Objective	Measurement Method	Qualification Level	Status
<b>4.8</b>	<b>EPICS Support</b>			
	All information that could be valuable for operations support shall be provided to EPICS. This included event capture, trending, and problem diagnosis.	Design Review		
<b>4.9</b>	<b>Backward Compatibility</b>			
	Retro-fit capability to Generation-1 systems	Design Review		

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